

Final Report:

Aircraft Radiation and Aerosol Measurements Near Hawaii: Satellite Validation At the Moby Buoy and the HOTS Site.

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INTRODUCTION

Aircraft measurements were carried out over the MOBY (Marine Optical Buoy) and the HOT (Hawaii Ocean Time-Series) sites near Hawaii to test/validate EOS-AM1 satellite algorithms. Measurements were made on

1998 Measurements	(Feb. 7, 1998) (Feb. 9, 1998) (Feb. 10, 1998) (Feb. 11, 1998)
1999 Measurements	(May 9, 1999) HAT01 (May 11, 1999) HAT02 (May 29, 1999) HAT03 (Aug. 14, 1999) HAT04
2000 Measurements	(Jan. 25, 2000) HAT05 (Feb. 29, 2000) HAT06 (Mar. 19, 2000) HAT07 (June 21, 2000) HAT08 (June 23, 2000) HAT09 (June 28, 2000) HAT10 (Dec. 11, 2000) HAT11 (Dec. 7, 2000) HAT12 (Dec. 8, 2000) HAT13
2001 Measurements	(Oct. 19, 2001) HAT14 (Dec. 06, 2001) HAT15
2002 Measurements	(Apr. 17, 2002) HAT16.

The aircraft measurements include:

AIRCRAFT RADIATION MEASUREMENTS (John Porter)

- AEROSOL OPTICAL DEPTH (MICROTOPS 5 λ) (all flights)
- SKY RADIANCE (from 350-1100 nm) (on selected flights)
- UPWELLING RADIANCE (from 350-1100 nm) (on selected flights)

- DOWNWELLING IRRADIANCE (BROADBAND AND SPECTRAL) (on several flights)
- UPWELLING IRRADIANCE (BROADBAND AND SPECTRAL) (on several flights)

AIRCRAFT IN-SITU AEROSOL MEASUREMENTS (Antony Clarke)

- AEROSOL SCATTERING COEFFICIENT (b_{sp} at 530nm) (on selected flights)
- AEROSOL SIZE DISTRIBUTION (on selected flights)
 - (Custom MET1-H OPC, 0.1-6 μ m) (on selected flights)
 - (External FSSP, 0.5-20 μ m) (on selected flights)
- CONDENSATION NUCLEI CONCENTRATION ($D_p > 0.01 \mu$ m) (on selected flights)

ADDITIONAL MEASUREMENTS

- GPS (AIRCRAFT POSITION) (on most flights)
- AMBIENT RELATIVE HUMIDITY (on most flights)
- AMBIENT TEMPERATURE (on most flights)
- PRESSURE (on most flights)

The instruments were mounted on dedicated aircraft doors and are installed on the light aircraft prior to flight. This approach requires little modification to the plane. We use a Piper Seneca or a Chieftan aircraft, to climb above the trade wind inversion (~2.1 km) over Hawaii. Aircraft flights are designed to fly over the ship or buoy at altitude for 20 minutes, then descend at the time of the satellite overpass and make additional low-level measurements for 20 more minutes. The high and low level flight tracks are flown along the satellite azimuth-viewing angle (and at 180 degrees to it) in order to have the same viewing angle as the satellite for our scanning radiometer. The data sets collected are placed on our web sites where anyone can download them (<http://www.soest.hawaii.edu/porter> or <http://pali.soest.hawaii.edu>). Raw data is available upon request.

PUBLICATIONS SUPPORTED BY THIS GRANT

Porter, J. N., A.D. Clarke, and B. R. Lienert, Aircraft/Surface Derived Aerosol Optical Properties Near Hawaii For Satellite Validation, Proceedings of the SPIE Remote Sensing of the Atmosphere, Environment and Space, Sendai, Japan, ISBN 0-7803-6362-0, 167-174, 2001.

Lienert, B.R., J.N. Porter, and S.K. Sharma, Repetitive Genetic Inversion of Optical Extinction Data, Applied Optics, vol. 40, No. 21, 3476-3482, 2001.

Lienert, B, J.N. Porter, N. C. Ahlquist, D. Harris, S.Sharma, A 50 MHz Logarithmic Amplifier for use in Lidar Measurements, J. of Atmospheric and Oceanic Technology, 19, 654-657, 2002.

Porter, J.N., K. Horton, P. Mougini-Mark, B. Lienert, E. Lau, J. Sutton, T. Elias, and C. Oppenheimer, Lidar and Sun Photometer Measurements of The Hawaii Pu'u O'o Volcano Plume: Estimates of SO₂ and Aerosol Flux Rates and SO₂ Lifetimes. (accepted in Geophysical Research Letters, 2002).

Porter, J.N., B. Lienert, S. K. Sharma, and H. W. Hubble, A Low Cost Portable Lidar System To Measure Aerosol Optical Properties, (accepted in J. of Atmospheric and Oceanic Tech., Dec. 2002).

Clarke, A.D., and N. C. Ahlquist, A Miniature Optical Particle Counter for In-Situ Aerosol Research, Journal of Atmospheric and Oceanic Technology, accepted Feb 2002.

Porter, J.N., S.K. Sharma, B. R. Lienert, and E. Lau, Aerosol Scattering Fields Over Bellows Beach, Oahu During the SEAS Experiment, (submitted to J. Atmospheric and Oceanic Technology, 2002).

B. R. Lienert, J. N. Porter and S. K. Sharma, Aerosol Size Distributions from Genetic Inversion of Polar Nephelometer Data (submitted to J. Atmospheric and Oceanic Tech., May 2002)

Papers in Progress Which Received Support From This Grant

Porter, J.N. and others, Aerosol Phase function measurements of Sea Salt and Volcanic Aerosols Near Hawaii (to be submitted GRL)

Porter, J.N., Deriving Aerosol Phase function and Size Information from Multi-Wavelength Lidar, Using Realistic Models To Limit the Range of Aerosol Possibilities, (in preparation for Applied Optics).

Porter, J.N and T. Nielsen, Atmospheric Correction Near Hawaii: Clear Sky and Volcano Plumes (PORSEC2002, Bali, Indonesia).